# Validation and Verification of Rare and Mislabeled Plant Specimens at Whiskeytown National Recreation Area: Final Report

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## Introduction

Whiskeytown National Recreation Area's vascular plant list is based largely on an inventory conducted by David Biek (a California Native Plant Society volunteer) from 1985 to 1987. Biek's flora (1988) and associated voucher specimens contain the most comprehensive information on the park's flora gathered to date. However, findings from recent vegetation related projects in the park (Smith et al 2003, Mathiasen 2005, Bunn 2005, Bunn et al 2005, Bradley et al 2006) have lead to a growing uncertainty in the accuracy of the park's plant list. Of particular concern are the findings of Bunn (2005) that illustrate that 13 out of 26 CNPS listed rare plants on the park's list are either misidentifications or range extensions of the species.

Due to this growing uncertainty and its potential to compromise the park's NPS Biological Inventory goals, Whiskeytown staff drafted a proposal to begin validating the accuracy of the park's vascular plant list. During the 2004 certification of the park's plant list in NPSpecies, the existence of a voucher specimen in the park's herbarium or the Shasta College Herbarium was a primary factor in determining a species "Park Status" rating. Therefore, the first priority of the proposal was to obtain some measure of the reliability of these voucher specimens as evidence for a species presence in the park. Thanks to funding provided by the Klamath Network Inventory and Monitoring Program, voucher specimens from the Whiskeytown and Shasta College Herbaria were validated by experts at the Jepson Herbarium. The results of this validation process are presented here.

## Methods

Specimens in need of validation were identified in a number of ways. Park staff decided that all un-validated rare plant specimens and those specimens that would represent range extensions of the species were the top priorities for validation in this project. Potential range extensions were determined using existing data on the Whiskeytown flora, species range descriptions found in the Jepson Manual (Hickman 1993 and on-line Interchange), and county distributions of species as determined by the Consortium of California Herbaria specimen database. Specimens housed in the Whiskeytown or Shasta College herbaria that were collected in the park, but represented species otherwise unknown from Shasta County were considered for validation by university experts. In addition, plants that the original collector had marked as uncertain determinations (indicated by a "?" on the specimen label), plants identified to the genus level only, and plants with an uncertain

taxonomic status (Hickman 1993 and on-line Jepson Interchange) were also considered for validation.

## Results

Overall, 123 specimens from the Whiskeytown Herbarium and 9 specimens from the Shasta College Herbarium were targeted for validation. These specimens were sent to Margriet Wetherwax, Managing Editor of the Jepson Flora Project at Jepson Herbarium, for identification. Of the 132 specimens examined, 56 specimens (42%) were found to be incorrectly identified, and 18 additional specimens were identified to a lower taxonomic level (i.e. specimens labeled with a genus were identified to species and those labeled with a species epithet were identified to ssp. or var.). Rare plants were the most commonly misidentified specimens (Table 1) with 12 out of 15 (80%) submitted specimens determined to be other species. Uncertainty on the part of the original collector also led to a high percentage (49%) of misidentification. Those species identified as potential range extensions were less problematic but still had a high (37%) error rate.

Table 1. Summary of plants submitted to the Jepson Herbarium for validation.

| Category | # Specimens | # Identification Errors | # Identified to Lower Level |
|---|---|---|---|
| Rare plant | 15 | 12 | N/A |
| Potential range extension | 51 | 19 | 0 |
| Original collector unsure of ID | 37 | 18 | 1 |
| Taxonomic uncertainty | 15 | 7 | 4 |
| Identified to genus level only | 14 | N/A | 13 |
| **TOTALS:** | **132** | **56** | **18** |

As a result of these determinations, 36 new species names have been added to the park's species list (Table 2) and substantial changes have been made to the park's rare plant and NPSpecies certified plant lists. Additionally, Jepson Herbarium staff determined that some of the specimens from this project represent range extensions of the species in the state. In these cases, herbarium staff made copies of the voucher sheets and incorporated the park's specimens in a database for the second edition of the Jepson Manual (M. Wetherwax, personal communication).

## Actions and Future Direction

Annotation labels reflecting Margriet Wetherwax's determinations were added to all 132 specimens, and the ANCS+ catalog records were updated accordingly. These updated records were emailed to the NPSpecies Data Manager in Fort Collins, Colorado and uploaded to the park's NPSpecies data file. Using the information gathered from this project, the park's vascular plant list was submitted to the Klamath Network Data Manager for recertification. The newly recertified list now contains the 36 new species names listed in Table 2 and has new "Park Status" ratings for all applicable species names, including "False Report" determinations for 42 species previously thought to occur in the park.

Table 2. Herbarium specimens that were misidentified or further resolved to a lower taxonomic level (* indicates species previously unknown to the park). Specimen name is the original name provided on the herbarium label, Catalog # is the number assigned for Whiskeytown museum management (RESC indicates specimens housed at the Shasta College Herbarium), and Validated Name is the determination made by the Jepson Herbarium staff.

| Family | Specimen Name | Catalog # | Validated Name |
|---|---|---|---|
| Alismataceae | Sagittaria calycina | 2731 | Sagittaria cuneata* |
| Asclepiadaceae | Asclepias californica | 4311 | Asclepias eriocarpa* |
| Asteraceae | Erigeron inornatus | 683 | Erigeron inornatus var. inornatus* |
| Asteraceae | Erigeron inornatus var. viscidulus | 2804 | Erigeron bioletti* |
| Asteraceae | Grindelia camporum | 690 | Grindelia hirsutula* |
| Asteraceae | Helenium | 691 | Helenium puberulum |
| Asteraceae | Malacothrix | 2772 | Malacothrix floccifera |
| Asteraceae | Malacothrix | 2773 | Malacothrix floccifera |
| Berberidaceae | Berberis dictyota | 726 | Berberis pinnata ssp. pinnata* |
| Berberidaceae | Berberis piperiana | 727 | Berberis aquifolium var. dictyota |
| Brassicaceae | Barbarea verna | 752 | Barbarea orthoceras |
| Brassicaceae | Brassica curvisiliqua | 768 | Rorippa curvisiliqua* |
| Brassicaceae | Streptanthus tortuosus | 771 | Streptanthus tortuosus var. tortuosus |
| Brassicaceae | Streptanthus tortuosus | 2768 | Streptanthus tortuosus var. orbiculatus* |
| Campanulaceae | Campanula medium | 776 | Campanula rapunculoides (cultivated)* |
| Caprifoliaceae | Symphoricarpos acutus | 782 | Symphoricarpos albus var. laevigatus |
| Cornaceae | Cornus | 2774 | Cornus sericea ssp. occidentalis* |
| Crassulaceae | Sedum | 804 | Sedum cf. oregonense* |
| Cyperaceae | Carex | 2737 | Carex subbracteata* |
| Cyperaceae | Carex cusickii | 813 | Carex gynodynama* |
| Cyperaceae | Eleocharis parvula var. coloradoensis | 827 | Eleocharis acicularis var. bella* |
| Cyperaceae | Scirpus validus | 832 | Scirpus acutus var. occidentalis |
| Euphorbiaceae | Euphorbia glyptosperma | 850 | Chamaesyce ocellata ssp. ocellata* |
| Fabaceae | Amorpha californica var. napensis | 852 | Amorpha californica var. californica* |
| Fabaceae | Lathyrus vestitus ssp. bolanderi | 864 | Lathyrus vestitus var. ochropetalus* |
| Fabaceae | Lotus crassifolius | 858 | Lotus crassifolius var. crassifolius |
| Fabaceae | Lotus grandiflorus | 859 | Lotus grandiflorus var. grandiflorus |
| Fabaceae | Lupinus albifrons | 892 | Lupinus albifrons var. collinus * |
| Fabaceae | Lupinus formosus | 897 | Lupinus albicaulis* |
| Fabaceae | Lupinus latifolius | 898 | Lupinus latifolius var. latifolius |
| Fabaceae | Vicia | 2815 | Vicia cracca* |
| Geraniaceae | Geranium pilosum | 922 | Geranium carolinianum |
| Iridaceae | Iris | 942 | cf. Iris hartwegii ssp. pinetorum |
| Juncaceae | Juncus marginatus | RESC | Juncus orthophyllus |
| Juncaceae | Juncus marginatus | RESC | Juncus orthophyllus |
| Juncaceae | Juncus orthopyllus | 2753 | Juncus sp. [missing diagnostic characters] |
| Liliaceae | Allium tribracteatum | 628 | Allium cratericola* |
| Liliaceae | Triteleia | 637 | Triteleia ixioides ssp. anilina |
| Liliaceae | Triteleia crocea | 636 | Triteleia ixioides ssp. anilina |
| Onagraceae | Clarkia mildrediae | 1019 | Clarkia stellata* |
| Onagraceae | Clarkia virgata | 1022 | Clarkia stellata* |
| Onagraceae | Epilobium | 1023 | Epilobium pallidum* |
| Onagraceae | Oenothera hookeri | 1030 | Oenothera elata ssp. hirsutissima * |

Table 2 continued.

| Family | Specimen Name | Catalog # | Validated Name |
|---|---|---|---|
| Oxalidaceae | Oxalis laxa | 1047 | Oxalis corniculata |
| Poaceae | Aira elongata | 2854 | not Aira; too far along for determination |
| Polemoniaceae | Navarettia intertexta | 2850 | Navarretia intertexta ssp. intertexta* |
| Polygonaceae | Eriogonum | 2759 | Eriogonum vimineum |
| Polygonaceae | Eriogonum umbellatum | 2881 | Eriogonum nudum var. pubiflorum |
| Polygonaceae | Eriogonum umbellatum | 2771 | Eriogonum umbellatum var. polyanthum* |
| Polygonaceae | Eriogonum umbellatum var. bahiiforme | 2770 | Eriogonum umbellatum var. polyanthum* |
| Polygonaceae | Eriogonum vimineum | 2883 | Eriogonum nudum var. pubiflorum |
| Polygonaceae | Rumex salicifolius | 2895 | Rumex salicifolius var. denticulatus* |
| Polygonaceae | Rumex salicifolius var. salicifolius | 2760 | Rumex salicifolius var. denticulatus* |
| Polypodiaceae | Polypodium californicum | 1048 | Polypodium calirhiza* |
| Ranunculaceae | Delphinium cardinale | RESC | Delphinium nudicaule |
| Ranunculaceae | Delphinium cardinale | RESC | Delphinium nudicaule |
| Ranunculaceae | Delphinium hesperium | 1087 | Delphinium hesperium ssp. hesperium* |
| Ranunculaceae | Delphinium hesperium | RESC | Delphinium nuttallianum* |
| Ranunculaceae | Delphinium patens | 1089 | Delphinium hesperium ssp. hesperium* |
| Rosaceae | Amelanchier pumila | 2778 | Amelanchier utahensis |
| Rosaceae | Potentilla | 2775 | Potentilla glandulosa ssp. ashlandica* |
| Rosaceae | Rosa californica | 1121 | Rosa pisocarpa* |
| Rosaceae | Rosa californica | 1120 | Rosa pisocarpa* |
| Rubiaceae | Galium asperrimum | RESC | Galium parisiense |
| Rubiaceae | Galium nuttallii | 1136 | Galium porrigens var. porrigens* |
| Salicaceae | Salix lasiandra | 2729 | Salix laevigata |
| Salicaceae | Salix melanopsis | 2767 | Salix lasiolepis |
| Salicaceae | Salix scouleriana | 1148 | Salix lasiolepis |
| Saxifragaceae | Lithophragma campanulatum | 1155 | Lithophragma heterophyllum* |
| Scrophulariaceae | Lindernia anagallidea | 1180 | Lindernia dubia var. dubia* |
| Scrophulariaceae | Mimulus | 1185 | Mimulus layneae |
| Tamaricaceae | Tamarix pentrandra | 1212 | Tamarix ramosissima* |
| Valerianaceae | Valerianella carinata | 1219 | Valerianella locusta * |
| Verbenaceae | Verbena officianalis | 1220 | Verbena lasiostachys var. scabrida |

This project was a good first step toward validating evidence for the vascular plant species that appear on Whiskeytown's NPSpecies plant list; however, additional steps should be taken to further validate those specimens that were not included in this project. In particular, a number of specimens from the Whiskeytown Herbarium (Table 3) were identified for future validation during an in-depth verification of the park's ANCS+ records. There may also be other specimens that need validation by an outside expert; however, a process to determine which of the remaining 627 specimens should be targeted has yet to be developed.

Table 3. Specimens in the Whiskeytown Herbarium recommended for validation by an outside expert.

| Family | Specimen Name | Catalog # |
|---|---|---|
| Anacardiaceae | Rhus trilobata var. quinata | 642 |
| Asteraceae | Arctium minus | 662 |
| Asteraceae | Matricaria chamomilla | 707 |
| Asteraceae | Xanthium strumarium var. canadense | 724 |
| Caprifoliaceae | Symphoricarpos hesperius | 2741 |
| Cucutaceae | Cuscuta ceanothi | 810 |
| Fabaceae | Lotus balsamiferous | 856 |
| Fabaceae | Medicago hispidula | 2779 |
| Juncaceae | Juncus acuminatus forma sphaerocephalus | 964 |
| Juncaceae | Juncus acuminatus forma sphaerocephalus | 1229 |
| Lamiaceae | Stachys rigida | 1012 |
| Portulaceae | Montia parviflora | 1051 |
| Portulaceae | Montia parviflora | 1052 |
| Portulaceae | Montia perfoliata var. depressa | 1055 |
| Pteridaceae | Cheilanthes gracillum | 1068 |
| Pteridaceae | Pityogramma triangularis | 1073 |
| Rosaceae | Potentilla glandulosa | 1115 |
| Rosaceae | Potentilla glandulosa | 2776 |
| Scrophulariaceae | Keckiella breviflora | 1177 |

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